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ADSORPTIVE SHEET AND AIR CLEANING FILTER  
[Kyuchakusei shito oyobi kuki joka yo fuiruta]

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APPLICANT	(71):	TOYOBO CO., LTD.
TITLE	(54):	ADSORPTIVE SHEET AND AIR CLEANING FILTER
FOREIGN TITLE	[54A]:	KYUCHAKUSEI SHI-TO OYOBI JOKA YO FUIRUTA

## Specifications

### 1. Title of the Invention

Adsorptive Sheet and Air Cleaning Filter

### 2. Claims

(1) An adsorptive sheet characterized by containing (a) 10 to 80 parts by weight fine activated carbon particles with an average particle size of 60 to 150  $\mu\text{m}$ , (b) 5 to 50 parts by weight supporting fibers having an outer surface area of at most  $1 \text{ m}^2/\text{g}$ , and (c) 1 to 30 parts by weight water-swellable or hot-melt fibers.

(2) An air cleaning filter characterized by being constituted by laminating the adsorptive sheet in claim (1) with an air-permeable reinforcing sheet.

### 3. Detailed Specifications

(Field of Industrial Utilization)

The present invention pertains to an adsorptive sheet used as an adsorption element, and an air cleaning filter with said adsorptive sheet used as a component.

(Prior Art)

Activated carbon exhibits powerful adsorption capacity with respect to aerosols and solutes in solutions; hence, it is used in cleaning, debromination, or the like of gases and liquids. There are methods in which the air desired to be cleaned is ventilated through an air cleaning filter in a direction orthogonal to the activated carbon molded like a sheet as one (1) of the techniques for applying activated carbon to air cleaning

filters. However, of the activated carbons, there are problems with fine activated carbon particles having a high adsorption capacity because they are not easily molded into filtration membranes themselves. Even if a filtration membrane can be formed by using any kind of carrier temporarily, it peels easily from the carrier and is washed away. Thus, development of a technique for being able to effectively utilize the above-mentioned fine activated carbon particles as a raw material for air cleaning filter is desired.

(Problems Which the Invention Intends to Solve)

Techniques for fixing fine activated carbon particles with an adhesive or fibrillated fibers (Tokkai No. 55-70342, Tokko No. 56-49608, etc.) also have proposed as link for techniques for effectively utilizing fine activated carbon particles as raw materials for air cleaning filters. However, there is a problem with these techniques because the resistance to ventilation increases and it is difficult to apply the fine activated carbon particles as raw materials for air cleaning filters. In addition, sheets wherein a porous film material was impregnated with fine activated carbon particles, sheets wherein fine activated carbon particles were dispersed in and fixed to a web comprising microfibers, and other sheets, also have been proposed (e.g., Tokko No. 52-4934). However, these kinds of techniques still could not satisfy the adsorption volume, ease of desorption of the activated carbon, etc.

The present invention was achieved in view of this kind of consideration, and the object thereof is to propose an air cleaning filter with an outstanding adsorption capacity with respect to malodorous gases and has satisfactory workability for folding or the like, which is a required general characteristic, and the most suitable adsorptive sheet used as an adsorption raw material for this kind of air cleaning filter.

(Means Used to Solve the Problems)

The gist of the adsorptive sheet pertaining to the present invention is to contain (a) 10 to 80 parts by weight fine activated carbon particles with an average particle size of 60 to 150  $\mu$ m, (b) 5 to 50 parts by weight supporting fibers having an outer surface area of at most 1 m<sup>2</sup>/g, and (c) 1 to 30 parts by weight water-swellaable or hot-melt fibers.

In addition, the most suitable air cleaning filter is obtained by laminating this adsorptive sheet with an air-permeable reinforcing sheet.

(Effects)

The present invention is constituted as stated above. But upon investigating adsorptive sheets formed by mixing (a) fine activated carbon particles with a prescribed average particle size, (b) support fibers with an outer surface area of a prescribed value or less, and (c) water-swellaable fibers or hot-melt fibers, at a specified ratio, it was discovered that the sheet was outstanding in adsorbing capacity and the air permeability also was satisfactory. Furthermore, they discovered

that a sheet in which an air-permeable reinforcing sheet was laminated on this adsorptive sheet could be made into a satisfactory air cleaning filter from the standpoint of workability without losing the characteristics of the above-mentioned adsorptive sheet, which led them to achieving the present invention.

It is necessary that the average particle size be 60 to 150  $\mu\text{m}$  due to values with JIS standard sieves (JIS Z8801) by considering the air permeability, loss of activated carbon, and paper making ability, etc. of the fine activated carbon particles. More preferably, it is about 100 to 150  $\mu\text{m}$ . That is, if the average particle size is less than 60  $\mu\text{m}$ , the resistance to ventilation is too high. If it exceeds 150  $\mu\text{m}$ , not only does it easily fall off, but the folding workability is poor when making an air cleaning filter. In addition, the mixing ratio of the fine activated carbon particles and the other fibers (above-mentioned (a) and (b)) exhibits a tendency in which the more fine activated carbon particles there are, the higher the adsorptivity is, but, on the other hand, the lower the strength of the adsorptive sheet; hence, it is necessary that the mixing ratio of the fine activated carbon particles be at most 90 parts by weight from this standpoint. By contrast, if it is less than 10 parts by weight, a satisfactory adsorptivity is not obtained. Moreover, the adsorbing capacity of the fine activated carbon particles is based on JIS K1474 as a standard for judging the adsorptivity for malodorous gases. The adsorption amount of

toluene is given when it is measured. It is preferable that this adsorption amount be at least 20 % by weight.

Besides synthetic fibers, such as polyester, polyacrylonitrile, polyamide, and polyolefin fibers, cotton linter, cotton, pulp, rayon, glass fibers, ceramic fibers, carbon fibers, activated carbon fibers, and the like may be used for the support fibers. Preferably, they are pulp and rayon. The support fibers are fibrillated. If the air permeability and paper-making ability are considered, it is necessary that the outer surface area thereof be at most  $1 \text{ m}^2/\text{g}$ . In addition, it is necessary that the mixing ratio of the support fibers be 5 to 50 parts by weight. If it is less than 5 parts by weight, the paper making property becomes poor. If it exceeds 50 parts by weight, the adsorption effect becomes unsatisfactory. Moreover, it is preferable that these support fibers be short fibers with a fiber length of 3 to 20 mm. If it is less than 3 mm, the air permeability becomes poor. If it exceeds 20 mm, the paper making property becomes poor.

The water-swellable fibers and hot-melt fibers are the adhesion constituents (binders) during mixing. Polyvinyl alcohol fibers are cited for the water-swellable fibers and polyethylene fibers, mix polypropylene-polyethylene fibers, and the like are cited for the hot-melt fibers. It is preferable that the fiber length of these fibers be at most 20 mm. It is necessary that the mixing ratio of these fibers be 1 to 30 parts by weight. That is, if it is less than 1 part by weight, the fibers may

exhibit a function for an adhesion constituent. If it exceeds 30 parts by weight, the adhesive property decreases relatively. Moreover, the preferable ratio of these fibers is about 5 to 20 parts by weight.

The adsorptive sheet is formed by mixing each of the above-mentioned elements. But besides them, constituents having additional functions, such as deodorizing and antifungal functions, also may be included. Furthermore, it is preferable that the thickness of this adsorptive sheet be about 0.5 to 1.2 mm if the air permeability and workability are considered. In addition, it is preferable that the basis weight be at least 100 g/m<sup>2</sup>.

The most suitable air cleaning filter may be realized by laminating the above-mentioned adsorptive sheet with the air-permeable reinforcing sheet. Paper, non-woven fabrics and woven fabrics, and the like, with pulp, rayon, acetate, polyester, polyacrylonitrile, polyamide, polyolefin, and the like as the raw materials, may be used for the air-permeable reinforcing sheet, but it is preferable that it be a form of nonwoven sheet, such as paper or non-woven fabric, from the standpoint of the adhesiveness with the aforesaid adsorptive sheet. It is necessary that this air-permeable sheet not be the cause of an increase in the resistance to ventilation; hence, it is a thin, coarse construction. In addition, it is necessary that it be suitably stiff. Thus, blending the fiber constituents and the binders while forming said reinforcing sheet is preferable at a



weight ratio of about 60/40 to 80/20. In addition, it is preferable that the thickness of said sheet be 0.15 to 0.3 mm and that the basis weight be about 20 to 40 g/m<sup>2</sup>.

Moreover, while laminating the adsorptive sheet with the air-permeable sheet, it is necessary that the adsorptive sheet be in a wet state, but it is preferable that the percentage of water content at this time be at least 100 % by weight. In addition, it is preferable that both sheets be pressed adequately after lamination and before drying.

Figure 1 is a rough explanatory diagram showing an example of a device configuration while manufacturing the air cleaning filter pertaining to the present invention in a Fourdrinier-type paper making method. 1 is a reticulated endless belt; 2 is a container with a liquid for suspending the fine activated carbon particles support fibers and adhesion constituents; 3 and 4 are press rolls; 5 is a sheet-conveying endless belt; 6 is a rotating-type drying drum; 7 is a taking-up roll; 8 is an adsorptive sheet; 9 is an air-permeable reinforcing sheet; and 10 denotes an air-cleaning filter, respectively.

The suspension liquid dripped on the reticulated endless belt 1 from the container 2 in a cascading manner is filtered over the reticulated endless belt 1 to form the adsorptive sheet 8 on said belt 1. This adsorptive sheet 8 is placed on the reticulated endless belt 1 and moves. After it is pressed by the press roll 3, it is placed on the sheet-conveying endless belt 5 where it moves until a wet state. Meanwhile, the air-permeable

sheet formed separately is led to the rotating type drying drum 6 in a dry state, and it is laminated on the aforementioned adsorptive sheet 8 on said rotating-type drying drum 6 to become the air-cleaning filter 10. This filter 10 is dried as it is laminated after being pressed with the press roll 4, and then it is wound on the taking-up roll 7.

The present invention will be explained in further detail through the practical examples, but the below-mentioned practical examples are not the sort of examples limiting the present invention. Changing the design along the lines of all the aforementioned and postscript objects is included in the technical scope of the present invention.

(Practical Examples)

Various fine activated carbon particles, support fibers and adhesion constituents were mixed so as to get the ratios in the below-mentioned Table 1, and various adsorptive sheets with a 150 g/m<sup>2</sup> basis weight were prepared with a TAPPI-type paper machine. These adsorptive sheets were heated and dried at 120 to 130°C after laminating them with an air-permeable reinforcing sheet (basis weight: 30 g/m<sup>2</sup>, thickness: 0.2 mm), and air cleaning filters were prepared.

Each characteristic of each obtained air cleaning filter was examined, such as the toluene adsorptivity, pressure loss, tensile strength, activated carbon desorptivity, and paper-making property. These results are written side by side in Table 1.

Table 1 (1 of 2)

	(a) フィルタ成分構成								
	微粒子状活性炭 (b)			(c) 支持繊維			(d) バインダ		(e)
	平均 粒子径 ( $\mu\text{m}$ )	トルエン 吸着量 (g) (重量%)	比率 (重量部) (h)	(i)	比表面積 ( $\text{m}^2/\text{g}$ ) (j)	比率 (重量部) (k)	素材 (l)	比率 (重量部) (m)	空気透過率 (%)
(n) 実施例 1	105	35	65	レーヨン (p)	0.8	22	ポリビニル (q) アルコール繊維	13	ポリプロピレン (r)
実施例 2	145	50	65	"	0.5	22	"	13	"
実施例 3	145	25	75	"	0.8	15	" (r)	10	"
実施例 4	145	35	70	"	0.8	20	ポリプロピレン	10	"
(o) 比較例 1	74	35	65	"	0.8	22	ポリビニル (q) アルコール繊維	13	"
比較例 2	210	30	65	"	0.8	22	"	13	"
比較例 3	105	35	85	"	0.8	10	"	5	"

Key: a) Filter Components; b) Fine activated carbon particles; c) Support fibers; d) Binders; e) Air-permeable sheet; f) Average particle size ( $\mu\text{m}$ ); g) Adsorption amount of toluene (% by weight); h) Ratio (Weight parts); i) Raw material; j) Outer surface area ( $\text{m}^2/\text{g}$ ); k) Ratio (parts by weight); l) Raw material; m) Ratio (parts by weight); n) Practical Example; o) Comparative Example; p) Rayon; q) Polyvinyl alcohol fibers; r) Polypropylene.

Table 1 (2 of 2)

	(a) 特 性						
	(b) 坪 量 (g/m <sup>2</sup> )	(c) 厚 さ (mm)	(d) トルエン吸着量 (重量%)	(e) 圧損 (mmH <sub>2</sub> O)	(f) 引張強度 (kg/15mm幅)	活性炭脱落性 (g)	抄紙性 (h)
(i) 実施例 1	180	0.7	15	10	5.5	○	○
実施例 2	180	1.0	27	15	5.3	○	○
実施例 3	250	1.2	12	15	7.0	○	○
実施例 4	200	1.0	20	5	7.0	○	○
(j) 比較例 1	180	0.8	13	35	5.2	○	△
比較例 2	180	1.6	13	10	4.0	×	×
比較例 3	180	0.8	17	20	3.0	×	×

Key: a) Characteristic; b) Basis weight (g/m<sup>2</sup>); c) Thickness (mm); d) Adsorption amount of toluene (% by weight); e) Pressure loss (mmH<sub>2</sub>O); f) Tensile strength (kg/15 mm width); g) Activated carbon loss; h) Paper-making property; i) Practical Example; j) Comparative Example.

As evident from Table 1, the most suitable characteristics are provided with the air cleaning filters of the practical examples satisfying the requirements according to the present invention. Moreover, the adsorptive sheets in all the practical example are satisfactory from a workability standpoint.  
(Merits of the Invention)

According to the present invention, as stated above, an air cleaning filter with satisfactory air permeability, outstanding adsorbing capacity with respect to malodorous gases and satisfactory workability for folding may be realized along with the most suitable adsorptive sheet as an adsorption raw material for this kind of air cleaning filter.

#### 4. Brief Description of the Figures

Figure 1 is a rough explanatory diagram showing an example of a device configuration while manufacturing the air cleaning filter pertaining to the present invention in a Fourdrinear type paper-making method.

1: reticulated endless belt; 2: container; 3,4: press rolls; 5: sheet-conveying endless belt; 6: rotating type drying drum; 7: taking-up roll; 8: adsorptive sheet; 9: air-permeable reinforcing sheet; 10: air-cleaning filter

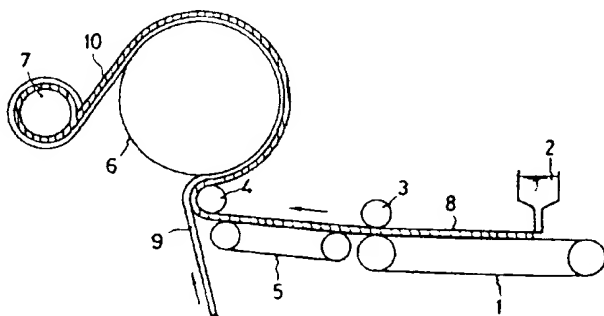


Figure 1

DERWENT-ACC-NO: 1990-204849

DERWENT-WEEK: 199830

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TITLE: Sheet absorbent for air purificn. filter -  
comprises fine active carbon particles, supporting fibres  
and water-swelling or hot melt fibres

PATENT-ASSIGNEE: TOYOBO KK[TOYM]

PRIORITY-DATA: 1988JP-0288096 (November 14, 1988)

PATENT-FAMILY:	PUB-NO	PUB-DATE	LANGUAGE
PAGES	MAIN-IPC		
JP 02135141 A		May 24, 1990	N/A 005
N/A			
JP 2679714 B2		November 19, 1997	N/A 004
B01J 020/28			

APPLICATION-DATA:	APPL-DESCRIPTOR	APPL-NO
PUB-NO		
APPL-DATE		
JP 02135141A	N/A	1988JP-0288096
November 14, 1988		
JP 2679714B2	N/A	1988JP-0288096
November 14, 1988		
JP 2679714B2	Previous Publ.	JP 2135141 N/A

INT-CL (IPC): B01D053/04, B01J020/28, B02J020/28

RELATED-ACC-NO: 1998-341400

ABSTRACTED-PUB-NO: JP 02135141A

BASIC-ABSTRACT:

Adsorbent comprises 10-80 pts. wt. active carbon fine particles(a) having average dia. 60-150 microns, 5-50 pts. wt. supporting fibres(b) having surface area up to 1 m<sup>2</sup>/g, and 1-30 pts. wt. water-swelling(c) or hot-melt(d) fibres. An air purificn. filter is also claimed, which is formed by laminating the sheet adsorbent and gas permeable reinforcing sheets(e).

(a) have a toluene adsorption capacity of over 20 wt.%. (b) are synthetic resin fibres such as polyester or polyacrylonitrile, cotton, pulp,

glass or  
ceramics fibres, or (active) carbon fibres, which are 3-20 mm long.  
(c) are  
PVA fibres. (d) are polyethylene fibres or polyethylene-polypropylene  
composite fibres. (e) are paper or (non)woven cloth made of pulp,  
rayon,  
acetate, polyester, polyamide or polyolefin, whose thickness and  
density are  
0.15-0.3 mm and 20-40 g/m2.

ADVANTAGE - The adsorbent has good gas permeability and higher  
absorption power  
for offensive odors.

CHOSEN-DRAWING: Dwg.0/1

TITLE-TERMS: SHEET ABSORB AIR PURIFICATION FILTER COMPRISE FINE ACTIVE  
CARBON

PARTICLE SUPPORT FIBRE WATER SWELLING HOT MELT FIBRE

DERWENT-CLASS: A88 J01 P41

CPI-CODES: A12-H04; A12-W11D; J01-E03C;

POLYMER-MULTIPUNCH-CODES-AND-KEY-SERIALS:

Key Serials: 0231 0232 0239 0248 0374 1283 1291 1977 1982 2007 2524  
2525 2528

2569 3250 2645 2654 3254 2674 3256 2702 2703 2820 2821

Multipunch Codes: 014 04- 041 046 047 050 067 072 074 076 141 143 144  
231 239

244 245 252 253 33& 481 483 52& 525 527 532 533 535 540 56& 575 58& 580  
596 597

600 664 665 666 667 688

SECONDARY-ACC-NO:

CPI Secondary Accession Numbers: C1990-088566

Non-CPI Secondary Accession Numbers: N1990-159027

PAT-NO: JP402135141A  
DOCUMENT-IDENTIFIER: JP 02135141 A  
TITLE: ADSORPTIVE SHEET AND AIR CLEANING FILTER  
PUBN-DATE: May 24, 1990

INVENTOR-INFORMATION:  
NAME  
SHIMIZU, HIROSHI  
ISHIZAKI, NOBUO

ASSIGNEE-INFORMATION:  
NAME  
TOYOBO CO LTD  
COUNTRY  
N/A

APPL-NO: JP63288096  
APPL-DATE: November 14, 1988

INT-CL (IPC): B01J020/28, B01D053/04  
US-CL-CURRENT: 55/527

ABSTRACT:

PURPOSE: To obtain the title sheet having excellent adsorptivity and good air permeability by making the sheet from a mixture of fine-particle activated carbon having specified mean particle diameter, a supporting fiber having a specified outer surface area, and a water-swollen br thermally fusible fiber in a specified ratio.

CONSTITUTION: The adsorptive sheet is made from a mixture contg. 10-80 pts.wt. of the fine-particle activated carbon having 60-150 $\mu$ m mean particle diameter, 5-50 pts.wt. of the supporting fiber having  $\leq 1\text{m}^2/\text{g}$  outer surface area, and 1-30 pts.wt. of the water-swollen or thermally fusible fiber. An air-permeable reinforcing sheet is laminated on the adsorptive sheet, and the laminated sheet is used as an air cleaning filter. By this method, the adsorptive sheet having good air permeability, excellent adsorptivity



to  
malodorous gases, and excellent workability in folding, etc., is  
obtained, and  
used as the adsorptive material for in air cleaning filter.

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1. Document ID: JP 02135141 A

L1: Entry 1 of 2

File: JPAB

May 24, 1990

PUB-NO: JP402135141A

DOCUMENT-IDENTIFIER: JP 02135141 A

TITLE: ADSORPTIVE SHEET AND AIR CLEANING FILTER

PUBN-DATE: May 24, 1990

## INVENTOR-INFORMATION:

NAME

COUNTRY

SHIMIZU, HIROSHI

ISHIZAKI, NOBUO

## ASSIGNEE-INFORMATION:

NAME

COUNTRY

TOYOCO CO LTD

N/A

APPL-NO: JP63288096

APPL-DATE: November 14, 1988

US-CL-CURRENT: 55/527

INT-CL (IPC): B01J 20/28; B01D 53/04

## ABSTRACT:

PURPOSE: To obtain the title sheet having excellent adsorptivity and good air permeability by making the sheet from a mixture of fine-particle activated carbon having specified mean particle diameter, a supporting fiber having a specified outer surface area, and a water-swollen or thermally fusible fiber in a specified ratio.

CONSTITUTION: The adsorptive sheet is made from a mixture contg. 10-80 pts.wt. of the fine-particle activated carbon having 60-150 $\mu$ m mean particle diameter, 5-50 pts.wt. of the supporting fiber having  $\leq$ 1m<sup>2</sup>/g outer surface area, and 1-30 pts.wt. of the water-swollen or thermally fusible fiber. An air-permeable reinforcing sheet is laminated on the adsorptive sheet, and the laminated sheet is used as an air cleaning filter. By this method, the adsorptive sheet having good air permeability, excellent adsorptivity to malodorous gases, and excellent workability in folding, etc., is obtained, and used as the adsorptive material for in air cleaning filter.

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Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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2. Document ID: JP 02135141 A, JP 2679714 B2

L1: Entry 2 of 2

File: DWPI

May 24, 1990

DERWENT-ACC-NO: 1990-204849  
DERWENT-WEEK 199830  
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TITLE Sheet absorbent for air purificn. filter - comprises fine active carbon particles, supporting fibres and water-swelling or hot melt fibres

## PATENT-ASSIGNEE:

ASSIGNEE	CODE
TOYOBO KK	TOYM

PRIORITY-DATA: 1988JP-0288096 (November 14, 1988)

## PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 02135141 A	May 24, 1990	N/A	005	N/A
JP 2679714 B2	November 19, 1997	N/A	004	B01J020/28

## APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
JP02135141A	November 14, 1988	1988JP-0288096	N/A
JP 2679714B2	November 14, 1988	1988JP-0288096	N/A
JP 2679714B2		JP 2135141	Previous Publ.

INT-CL (IPC): B01D 53/04; B01J 20/28; B02J 20/28

RELATED-ACC-NO: 1998-341400

ABSTRACTED-PUB-NO: JP02135141A  
BASIC-ABSTRACT:

Adsorbent comprises 10-80 pts. wt. active carbon fine particles(a) having average dia. 60-150 microns, 5-50 pts. wt. supporting fibres(b) having surface area up to 1 m<sup>2</sup>/g, and 1-30 pts. wt. water-swelling(c) or hot-melt(d) fibres. An air purificn. filter is also claimed, which is formed by laminating the sheet adsorbent and gas permeable reinforcing sheets(e).

(a) have a toluene adsorption capacity of over 20 wt.%. (b) are synthetic resin fibres such as polyester or polyacrylonitrile, cotton, pulp, glass or ceramics fibres, or (active) carbon fibres, which are 3-20 mm long. (c) are PVA fibres. (d) are polyethylene fibres or polyethylene-polypropylene composite fibres. (e) are paper or (non)woven cloth made of pulp, rayon, acetate, polyester, polyamide or polyolefin, whose thickness and density are 0.15-0.3 mm and 20-40 g/m<sup>2</sup>.

ADVANTAGE - The adsorbent has good gas permeability and higher absorption power for offensive odors.

CHOSEN-DRAWING: Dwg.0/1

TITLE-TERMS: SHEET ABSORB AIR PURIFICATION FILTER COMPRISE FINE ACTIVE CARBON PARTICLE SUPPORT FIBRE WATER SWELLING HOT MELT FIBRE

DERWENT-CLASS: A88 J01 P41

CPI-CODES: A12-H04; A12-W11D; J01-E03C;

## POLYMER-MULTIPUNCH-CODES-AND-KEY-SERIALS:

Key Serials: 0231 0232 0239 0248 0374 1283 1291 1977 1982 2007 2524 2525 2528  
2569 3250 2645 2654 3254 2674 3256 2702 2703 2820 2821

Multipunch Codes: 014 04- 041 046 047 050 067 072 074 076 141 143 144 231 239  
244 245 252 253 33& 481 483 52& 525 527 532 533 535 540 56& 575 58& 580 596 597  
600 664 665 666 667 688

SECONDARY-ACC-NO:

CPI Secondary Accession Numbers: C1990-088566

Non-CPI Secondary Accession Numbers: N1990-159027

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KMMC	Draw Desc	Image
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### Terms

### Documents

JP-02135141-\$.DID.

2

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10

Documents, starting with Document: 2

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B 01 D 53/04

識別記号

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(31) 発 明 者 清 水 博 滋賀県大津市堅田2丁目1番1号 東洋紡績株式会社総合  
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(34) 代 理 人 弁理士 植木 久一

PTO 2001-1179

S.T.I.C. Translations Branch

## 明 細 書

## 1. 発明の名称

吸着性シートおよび空気浄化用フィルター

## 2. 特許請求の範囲

(1) (a) 平均粒子径が60～150 $\mu$ mの微粒子状

活性炭: 10～80重量部

(b) 外表面積が1 $\text{m}^2/\text{g}$ 以下である支持繊維:

5～50重量部

(c) 水膨潤性繊維または熱溶解性繊維: 1～

30重量部

を含むことを特徴とする吸着性シート。

(2) 請求項(1)に記載の吸着性シートと通気性補強シートを積層して構成されることを特徴とする空気浄化用フィルター。

## 3. 発明の詳細な説明

〔産業上の利用分野〕

本発明は、吸着素子としての吸着用シート、および該吸着シートを構成要素とする空気浄化用フィルターに関するものである。

〔従来の技術〕

活性炭はエアロゾルや溶液中の溶質に対して強

力な吸着能を示すため、気体や液体の浄化或は脱臭等に利用される。活性炭を空気浄化用フィルターに適用する技術の一つとして、シート状に成形した活性炭に、浄化したい空気を直交方向に通気させる方法がある。しかしながら活性炭のうち吸着能力の高い微粒子状活性炭は、それ自体では濾過膜として成形することが容易でなく、仮に何らかの担体を用いて濾過膜を形成することができたとしても担体から簡単に剝離して流失してしまうという問題がある。こうしたことから上記微粒子状活性炭を空気浄化用フィルターの素材として有効に利用できる技術の開発が望まれている。

〔発明が解決しようとする課題〕

微粒子状活性炭を空気浄化用フィルターの素材として有効に利用する技術の一環として、例えば微粒子状活性炭を接着剤やフィブリル化繊維で固定する技術も提案されている(特開昭55-70342号、特公昭56-49608号等)。しかしながらこれらの技術では通気抵抗が高くな

り、空気浄化用フィルターの素材としては適用し難いという問題がある。また微粒子状活性炭、多孔質なフォーム材に添着させたシートや、微細繊維よりなるウェブに分散、固着させたシート等も提案されている（例えば特公昭52-49344号）。しかしながらこの様な技術においても、吸着容量、活性炭の脱離し易さ等の点で依然として満足し得るものではなかった。

本発明はこの様な事情に鑑みてなされたものであって、その目的とするところは、通気性が良好で、悪臭ガスに対する吸着性能にも優れ、且つ一般的特性として要求される折り曲げ加工等の加工性においても良好な空気浄化用フィルター、およびこの様な空気浄化用フィルターの吸着素材として最適な吸着性シートを提案する点にある。

〔課題を解決する為の手段〕

本発明に係る吸着性シートとは、

④平均粒子径が $60 \sim 150 \mu\text{m}$ の微粒子状活性炭：10～80重量部

⑤外表面積が $1 \text{ m}^2/\text{g}$ 以下である支持繊維：

抄紙性等を考慮して、平均粒子径がJIS標準ふるい（JIS Z 8801）による値で $60 \sim 150 \mu\text{m}$ であることが必要であり、より好ましくは $100 \sim 150 \mu\text{m}$ 程度である。即ち平均粒子径が $60 \mu\text{m}$ 未満であると通気抵抗が大きくなりすぎ、 $150 \mu\text{m}$ を超えると脱落が生じやすくなるばかりか空気浄化用フィルターとしたときの折り曲げ加工性に劣る。また微粒子状活性炭と他の繊維（上記④および⑤）の混抄率は、微粒子状活性炭が多いほど吸着性は増大するが、一方で吸着性シートの強度が低下する傾向を示すので好適な範囲を選定する必要がある。こうした観点からして微粒子状活性炭の混抄率は90重量部以下にする必要がある。これに対し10重量部未満になると良好な吸着性が得られない。尚微粒子状活性炭の吸着性能は、悪臭ガスに対する吸着性を判断する基準として、JIS K 1474に準拠して測定したときのトルエン吸着量が挙げられ、この吸着量が20重量%以上のものであるのが好ましい。

5～50重量部

⑥水膨潤性繊維または熱溶融性繊維：1～30重量部

を含む中に要旨を有するものである。

またこの吸着性シートと通気性補強シートを積層することによって最適な空気浄化用フィルターが得られる。

〔作用〕

本発明は上記の如く構成されるが、要は④所定の平均粒子径の微粒子状活性炭、⑤外表面積が所定値以下の支持繊維、⑥水膨潤性繊維または熱溶融性繊維を、特定の割合で混抄して形成される吸着性シートについて検討したところ、吸着性能に優れ通気性も良好であることを見出し、更にこの吸着性シートに通気性補強シートを積層したものは、上記吸着性シートの特性を損なうことなく加工性の点でも良好な空気浄化用フィルターとなり得ることを見出し、本発明を完成したものである。

微粒子状活性炭は、通気性、活性炭の脱落、

支持繊維としては、ポリエステル、ポリアクリロニトリル、ポリアミド、ポリオレフィン等の合成繊維の他、リントー、木綿、麻、木材パイプ、レーヨン、ガラス繊維、セラミック繊維、炭素繊維、活性炭素繊維等が使用でき、好ましくは木材パルプ、レーヨンである。支持繊維はフィブリル化したものであり、通気性、抄紙性を考慮すればその外表面積は $1 \text{ m}^2/\text{g}$ 以下であることが必要である。また支持繊維の混抄割合は5～50重量部とする必要があり、5重量部未満では抄紙性が悪くなり、50重量部を超えると吸着効果が不良となる。尚この支持繊維は繊維長が $3 \sim 20 \text{ mm}$ の短繊維であることが好ましく、 $3 \text{ mm}$ 未満では通気性が悪くなり、 $20 \text{ mm}$ を超えると抄紙性が悪くなる。

水膨潤性繊維や熱溶融性繊維は混抄時の接着成分（バインダー）となるものであり、水膨潤性繊維としてはポリビニルアルコール繊維、熱溶融性繊維としてはポリエチレン繊維やポリプロピレン—ポリエチレン複合繊維等が挙げられる。これら

の繊維は、繊維径が $20\mu\text{m}$ 以下であることが好ましい。この繊維の配合割合は、 $1 \sim 30$ 重量部とする必要がある。即ち $1$ 重量部未満では接着成分が十分に繊維と密着することができ、 $30$ 重量部を超えると接着性が相対的に低くなる。尚この繊維の好ましい割合は $5 \sim 20$ 重量部程度である。

上記各要素を混抄することによって吸着性シートが形成されるが、その他脱臭、防かび等の付随的機能を有する成分等を含んでいてもよい。尚この吸着性シートの厚みは、通気性や加工性を考慮すれば、 $0.5 \sim 1.2\text{mm}$ 程度のものが好ましい。また坪量は吸着性の点から $100\text{g}/\text{m}^2$ 以上が好ましい。

上記吸着性シートと通気性補強シートを積層することによって最適な空気浄化用フィルターが実現できる。通気性補強シートとしては木材パルプ、レーヨン、アセテート、ポリエステル、ポリアクリロニトリル、ポリアミド、ポリオレフィン等を素材とした紙や不織布、布等が使用できる

ル、5はシート運搬用無端ベルト、6は回転式乾燥ドラム、7は巻取ロール、8は吸着性シート、9は通気性補強シート、10は空気浄化用フィルターを夫々示す。

容器2からカスケード式に網状無端ベルト1上に落下された懸垂液は、網状無端ベルト1上で濾過されて該ベルト1上に吸着性シート8を形成する。この吸着性シート8は網状無端ベルト1上に載って移動され、プレスロール3でプレスされた後シート運搬用無端ベルト5に載って湿潤状態のまま移動される。一方別途形成された通気性補強シートは乾燥状態で回転乾燥ドラム6に導かれ、該回転乾燥ドラム6上で前記吸着性シート8と積層されて空気浄化用フィルター10となる。このフィルター10は、プレスロール4でプレスされた後積層されたまま乾燥され、巻取ロール7に巻き取られる。

以下本発明を実施例によって更に詳細に説明するが、下記実施例は本発明を限定する性質のものではなく、前・後記の趣旨に沿って設計変更する

が、前記吸着性シートとの接着性の面から紙や不織布等の繊維シート形態であることが好ましい。この通気性補強シートは通気抵抗の増大の原因になるはならないので、薄く且つ粗な構造であることが必要であり、また適度に強靱であることが必要である。こうしたことから、該補強シートを形成する際における繊維成分とバインダーの配合は重量割合で $60/40 \sim 80/20$ 程度が好ましい。また該シートの厚みは $0.15 \sim 0.3\text{mm}$ 、坪量は $20 \sim 40\text{g}/\text{m}^2$ 程度が好ましい。

尚吸着性シートと通気性シートを積層する際には、吸着性シートが湿潤状態であることが必要であるが、このときの含水率は $100$ 重量%以上であることが好ましい。また両シートは積層後、乾燥前に十分にブレフすることが好ましい。

第1図は、本発明に係る空気浄化用フィルターを長網式抄紙法によって製造する際の装置構成例を示す概略説明図であり、1は網状無端ベルト、2は微粒子状活性炭支持繊維および接着成分を懸垂させた液を入れる容器、3、4はプレスロー

ことはいずれも本発明の技術的範囲に含まれるものである。

#### [実施例]

各種の微粒子状活性炭、支持繊維および接着成分を、下記第1表の比率となる様に混抄した後、TAPPI式抄紙機で坪量 $150\text{g}/\text{m}^2$ の各種吸着性シートを作成した。これらの吸着性シートを湿潤状態で、ポリプロピレンからなる通気性補強シート（坪量 $30\text{g}/\text{m}^2$ 、厚み $0.2\text{mm}$ ）と積層後 $120 \sim 130^\circ\text{C}$ に加熱して乾燥し、空気浄化用フィルターを作成した。

得られた各空気浄化用フィルターについて、トルエン吸着性、圧損、引張強度、活性炭脱落性、抄紙性等の各特性を調査した。この結果を第1表に併記する。

(以下余白)



第 1 表 (1)

	フ ィ ル タ ー 構 成 要 件								
	微粒子状活性炭			支 持 綿 維			バインダ		造 成 性 補 強 シ ー ト
	平 均 粒 子 径 ( $\mu\text{m}$ )	ト ル エ ン 吸 着 量 (重量%)	比 率 (重量部)	素 材	外 表 面 積 ( $\text{m}^2/\text{g}$ )	比 率 (重量部)	素 材	比 率 (重量部)	
実施例 1	105	35	65	レーヨン	0.8	22	ポリビニル アルコール繊維	13	ポリプロピレン
実施例 2	145	50	65	"	0.5	22	"	13	"
実施例 3	145	25	75	"	0.8	15	"	10	"
実施例 4	145	35	70	"	0.8	20	ポリプロピレン	10	"
比較例 1	74	35	65	"	0.8	22	ポリビニル アルコール繊維	13	"
比較例 2	210	30	65	"	0.8	22	"	13	"
比較例 3	105	35	65	"	0.8	10	"	5	"

第 1 表 (2)

	特 性						
	坪 量 ( $\text{g}/\text{m}^2$ )	厚 さ ( $\text{mm}$ )	トルエン吸着量 (重量%)	圧 損 ( $\text{mmHg}$ )	引張強度 ( $\text{kg}/15\text{mm幅}$ )	活性炭脱落性	抄紙性
実施例 1	180	0.7	15	10	5.5	○	○
実施例 2	180	1.0	27	15	5.3	○	○
実施例 3	250	1.2	12	15	7.0	○	○
実施例 4	200	1.0	20	5	7.0	○	○
比較例 1	180	0.8	13	35	5.2	○	△
比較例 2	180	1.6	13	10	4.0	×	×
比較例 3	180	0.8	17	20	3.0	×	×



紙1表から明らかである様に、本発明で規定する要件を満足する実施例は、空気浄化用フィルターとして最適な特性を備えている。尚実施例のものは加工性の点についてもいずれも良好であった。

〔発明の効果〕

以上述べた如く本発明によれば、通気性が良好で、悪臭ガスに対する吸着性能にも優れ、且つ折り曲げ加工性においても良好な空気浄化用フィルターおよびこのような空気浄化用フィルターの吸着素材として最適な吸着性シートが実現できた。

4. 図面の簡単な説明

第1図は本発明に係る空気浄化用フィルターを長網式抄紙法によって製造する際の装置構成例を示す概略説明図である。

- 1…網状無端ベルト      2…容器
- 3,4…プレスロール
- 5…シート運搬用無端ベルト
- 6…回転式乾燥ドラム
- 7…巻取ロール      8…吸着性シート

9…通気性補強部材

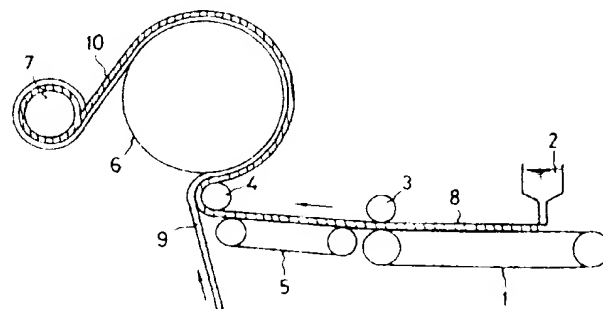
10…空気浄化用フィルター

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第1図



XP-002111575

- 1/1 - (C) WPI / DERWENT
- AN - 90-204849 q27!
- AP - JP880288096 881114; JP880288096 881114; qPrevious  
Publ. J02135141 !
- PR - JP880288096 881114
- TI - Sheet absorbent for air purificn. filter - comprises  
fine active carbon particles, supporting fibres and  
water-swelling or hot melt fibres
- IW - SHEET ABSORB AIR PURIFICATION FILTER COMPRISE FINE  
ACTIVE CARBON PARTICLE SUPPORT FIBRE WATER SWELLING HOT  
MELT FIBRE
- PA - (TOYM ) TOYOB0 KK
- PN - JP2135141 A 900524 DW9027 005pp  
- JP2679714B2 B2 971119 DW9751 B01J20/28 004pp
- ORD - 1990-05-24
- IC - B01D53/04 ; B01J20/28 ; B02J20/28
- FS - CPI;GMP1
- DC - A88 J01 P41
- AB - J02135141 Adsorbent comprises 10-80 pts. wt. active  
carbon fine particles(a) having average dia. 60-150  
microns, 5-50 pts. wt. supporting fibres(b) having  
surface area up to 1 m2/g, and 1-30 pts. wt.  
water-swelling(c) or hot-melt(d) fibres. An air  
purificn. filter is also claimed, which is formed by  
laminating the sheet adsorbent and gas permeable  
reinforcing sheets(e).
- (a) have a toluene adsorption capacity of over 20 wt. %.
  - (b) are synthetic resin fibres such as polyester or  
polyacrylonitrile, cotton, pulp, glass or ceramics  
fibres, or (active) carbon fibres, which are 3-20 mm  
long. (c) are PVA fibres. (d) are polyethylene fibres  
or polyethylene-polypropylene composite fibres. (e)  
are paper or (non)woven cloth made of pulp, rayon,  
acetate, polyester, polyamide or polyolefin, whose  
thickness and density are 0.15-0.3 mm and 20-40 g/m2.
  - ADVANTAGE - The adsorbent has good gas permeability and  
higher absorption power for offensive odors. (Dwg.0/1)